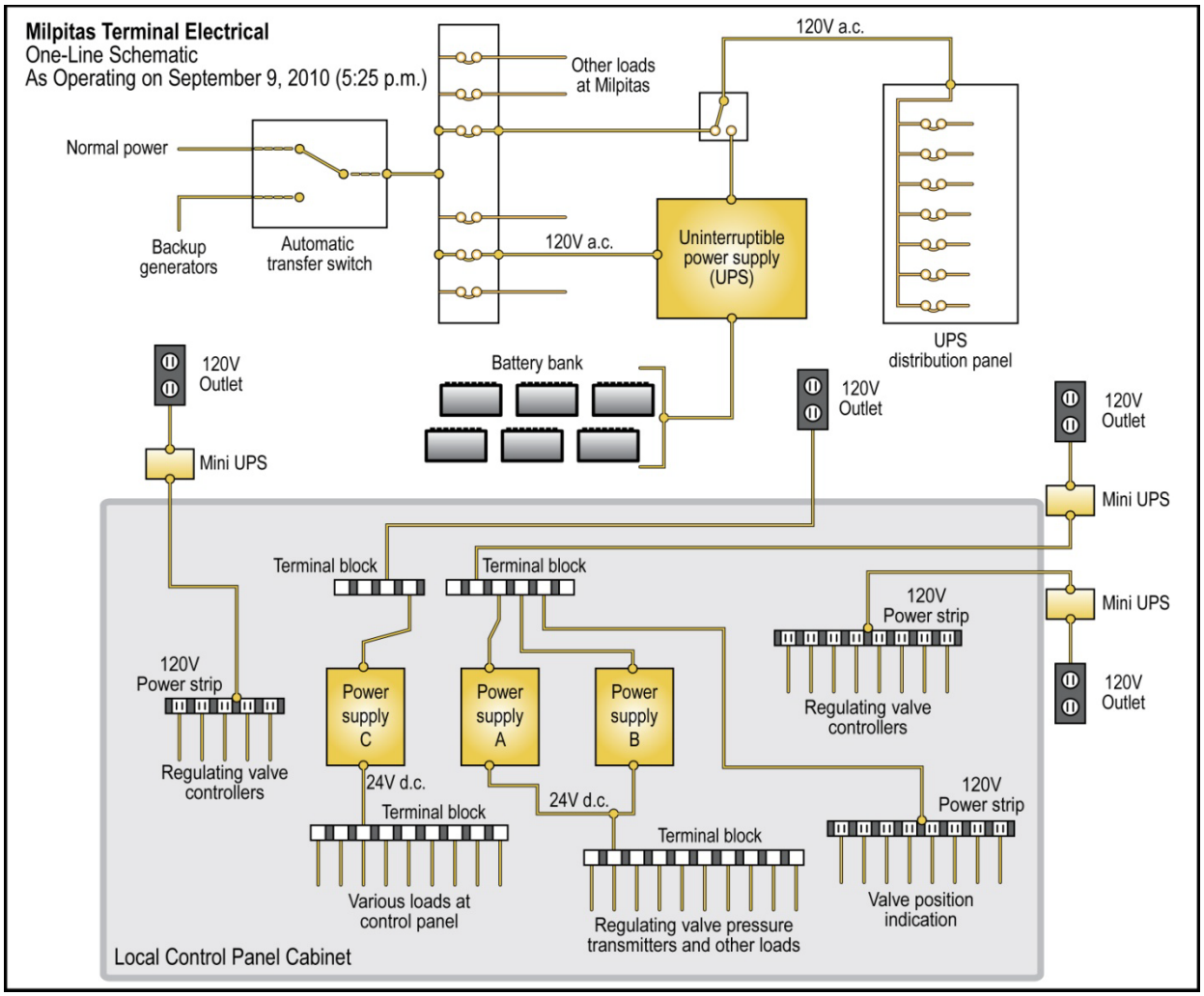

Figure 6b. Temporary electrical configuration at the Milpitas Terminal preceding the accident.

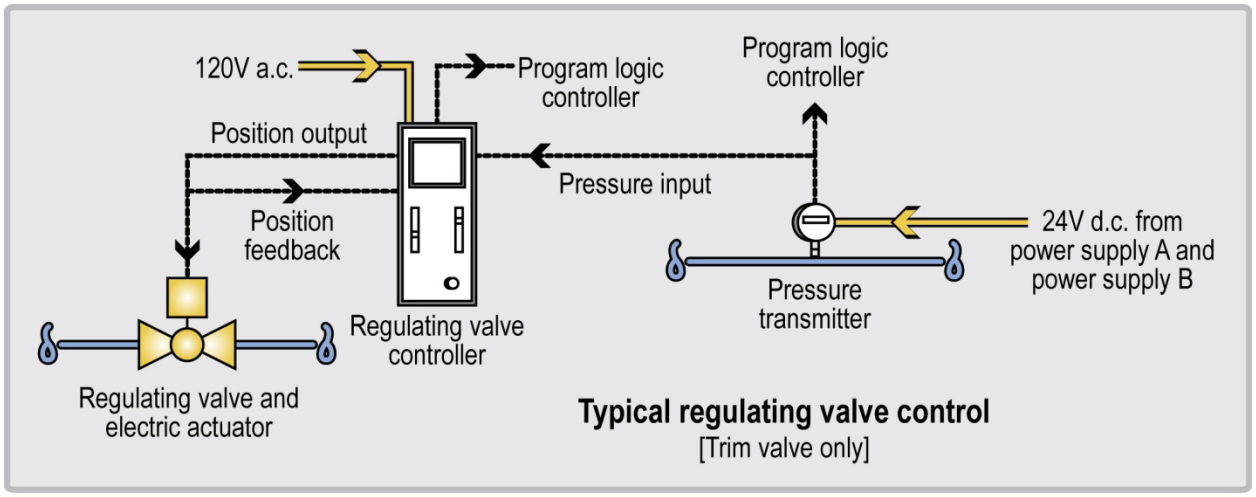

Figure 7. Schematic showing regulating valve control.

At 5:22 p.m., as a result of regulating valves fully opening and the erroneous signals caused by the erratic voltages, the SCADA center alarm console displayed over 60 alarms within a few seconds, including controller error alarms and high differential pressure and backflow alarms from the Milpitas Terminal. (See figure 8a.) These alarms were followed by high and high-high pressure alarms[13] on several lines leaving the Milpitas Terminal, including Line 132. At 5:25 p.m., SCADA operator C called the Milpitas technician to report the high pressure alarms, stating that they "look real." During this conversation, the Milpitas technician realized that the pressure and regulating valve controller displays on the local control panel had lost all data. At the same time, the SCADA consoles displayed constant pressures[14] on the downstream lines and showed all regulating and a majority of monitor and incoming line valves[15] at the Milpitas Terminal as not open.[16] (See figure 8b.)

At 5:28 p.m., the Milpitas technician called SCADA operator D to ask what pressure values were being displayed on his SCADA console. During the discussion, they both realized that the SCADA center was not receiving valid data for incoming and outgoing lines at the Milpitas Terminal. Operator D notified the Milpitas technician that his SCADA console was showing 458 psig at the Milpitas Terminal "mixer."[17] Operator D concluded that the regulating and/or station bypass valves may have opened. This was confirmed by the Milpitas technician. With all of the regulating valves wide open, the pneumatically controlled and actuated monitor valves limited pressure on the outgoing lines. The monitor valves were set at 386 psig;[18] however, due to a typical lag in the monitor valves response time, the pressure in the lines leaving the Milpitas Terminal peaked at 396 psig[19] between 5:22 p.m. and 5:25 p.m.

At 5:42 p.m., the Milpitas technician called the SCADA center and reported to SCADA operator C that the regulating valves on incoming Line 300B (the primary line feeding the mixer) had opened fully. Operator C reminded the Milpitas technician that he was unable to see valid pressures or valve positions from the Milpitas Terminal on his SCADA console. The Milpitas technician asked if he could reduce the local set point of the monitor valves from 386 to 370 psig to bring down the line pressures; operator C approved the reduction.

[13] High pressure alarms are set at or below the MOP, and high-high pressure alarms are set at MOP plus 3 psi.

[14] On a loss of data, the SCADA system displays the last valid reading.

[15] The valves on incoming lines are locally controlled at the Milpitas Terminal and are either fully open or closed.

[16] Any position less than 100 percent open is considered "not open."

[17] In the 1980s, a mixer was used at the Milpitas Terminal to mix several gas grades from various sources. The mixer has since been removed but the terminology is still used.

[18] The monitor valve set point is set locally. The PG&E monitor valves are set to a value above the MOP of the line but below the MAOP. SCADA operators have the ability to remotely set the monitor valve position but cannot override the local pressure set point.

[19] Until 5:22 p.m., the pressure had been 359 psig.

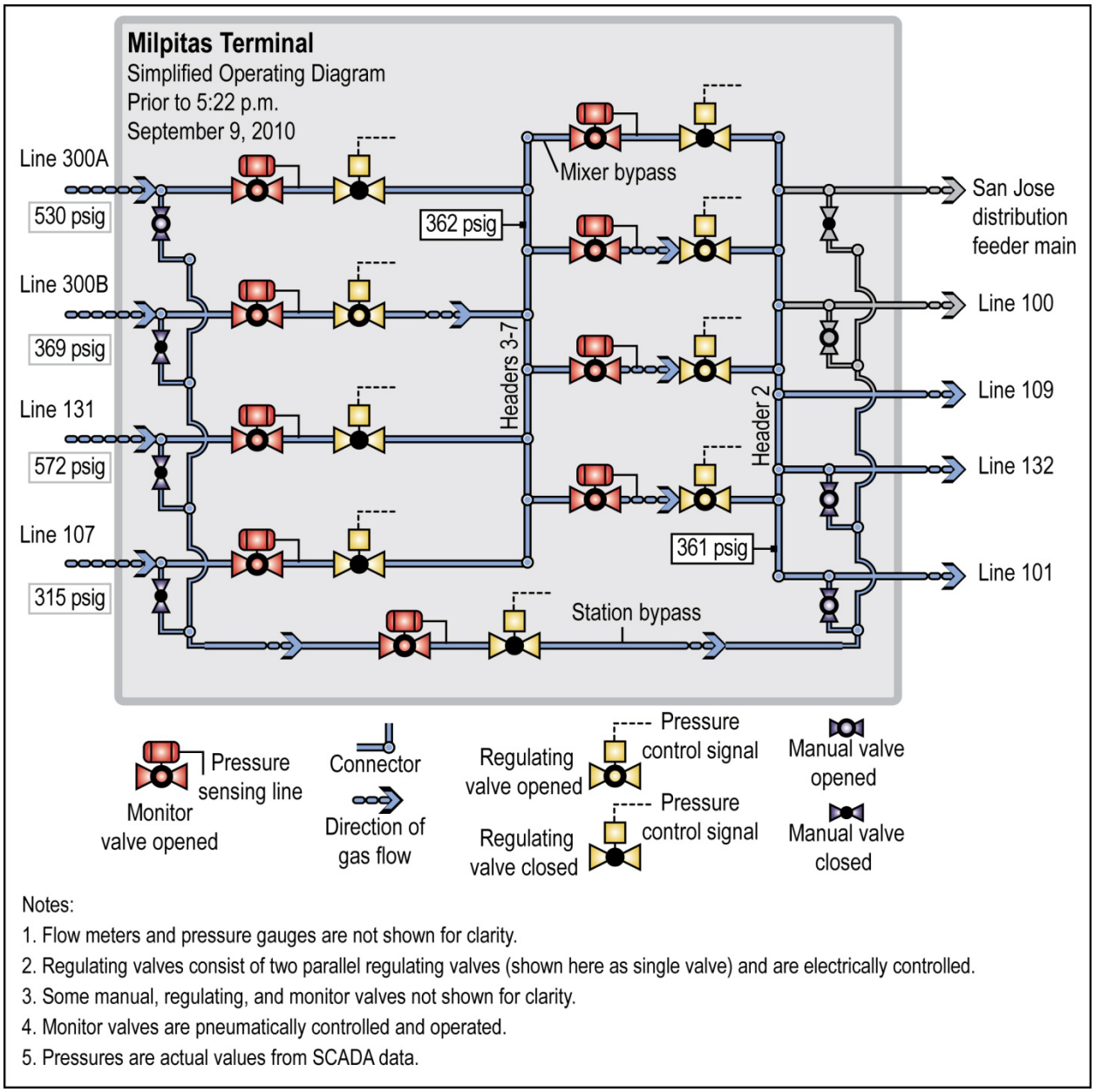

Figure 8a. Valve configuration at the Milpitas Terminal prior to 5:22 p.m.